

Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-55. (Cancelled)

56. (Currently Amended) A method comprising:

computing an antenna processing strategy to define a transmitted signal or to process a received signal for a remote user, based at least in part on a received signal data;

determining ~~one or more signatures~~ signature data of one or more interferers; and

modifying the antenna processing strategy to realize an improved null toward at least one interferer by incorporating the determined ~~one or more signatures~~ signature data of the one or more interferers with the received signal data to reduce one or both of antenna transmit signal strength in, and sensitivity of the antenna to signals from, one or more interferers.

57. (Previously Presented) The method of claim 56 wherein incorporating signature data relating to one or more interferers comprises:

combining the received signal data and the signature data; and

computing a modified processing strategy based, at least in part, on the combination.

58. (Previously Presented) The method of claim 57 wherein combining the received signal data and the signature data further comprises modifying one or more

characteristic features of the received signal data with an estimate of the one or more characteristic features in the signature data.

59. (Previously Presented) The method of claim 58 wherein the estimate includes a selectable parameter.

60. (Previously Presented) The method of claim 59 wherein the parameter selected is sufficiently large to cause a carrier to interference ratio (CIR) corresponding to the modified characteristic feature to be small.

61. (Previously Presented) The method of claim 59 wherein the parameter for a co-channel interferer is selected to cause a ratio on downlink of interferer transmit power to remote user transmit power to approximate a ratio of the modified feature estimate of interferer power to remote user power.

62. (Previously Presented) The method of claim 59 wherein the estimate of the one or more characteristic features of the received signal data comprises an estimate of the covariance of the received signal data.

63. (Previously Presented) The method of claim 62 wherein the covariance estimate comprises a noise-plus-interference-plus-signal covariance estimate.

64. (Previously Presented) The method of claim 62 wherein the covariance estimate comprises a noise-plus-interference covariance estimate.

65. (Previously Presented) The method of claim 62 wherein combining the received signal data and the signature data comprises:

computing a covariance estimate of the received signal data;
computing a covariance estimate of the interferer signature data for each
interferer; and
summing the covariance estimate of the received signal data, and the covariance
estimate of the interferer signature data scaled by a selectable parameter.

66. (Previously Presented) The method of claim 62 wherein combining the
received signal data and the signature data comprises:

performing a matrix factorization of the received signal data;
performing a matrix factorization of the interferer signature data for each
interferer;
scaling the factors of the matrix factorization of the interferer signature data by a
selectable parameter; and
combining the scaled factors and the factors of the matrix factorization of the
received signal data.

67. (Previously Presented) The method of claim 58 wherein combining the
received signal data and the signature data further comprises:

determining supplementary signal data from each interferer signature;
scaling the supplementary signal data by a selectable parameter; and
combining the received signal data and the scaled supplementary signal data.

68. (Previously Presented) The method of claim 67 wherein the parameter
selected is sufficiently large to cause a carrier to interference ratio (CIR) corresponding to
the modified characteristic feature to be small.

69. (Previously Presented) The method of claim 67 wherein the parameter for a co-channel interferer is selected to cause a ratio on downlink of interferer transmit power to remote user transmit power to approximate a ratio of the modified feature estimate of interferer power to remote user power.

70. (Previously Presented) The method of claim 67 wherein the supplementary signal data includes random samples generated from the interferer signature data.

71. (Previously Presented) The method of claim 67 wherein combining the received signal data and the scaled supplementary signal data comprises:
performing a matrix factorization of the received data and the signature data; and
combining the resulting factors.

72. (Previously Presented) The method of claim 56 wherein the signature data comprises a known signature for the one or more interferers.

73. (Previously Presented) The method of claim 56 wherein modifying the antenna processing strategy by incorporating signature data further comprises:
estimating the signature of one or more of the interferers; and
modifying the antenna processing strategy by incorporating the estimate as the interferer signature data.

74. (Previously Presented) The method of claim 73 wherein estimating the signature comprises determining a high likelihood estimate of an interferer signature, the

determination based on the assumption that no remote user signal and no other interferer signals are present.

75. (Previously Presented) The method of claim 73 wherein estimating the signature comprises determining a high likelihood estimate of an interferer signature, the determination based on the assumption that the remote user signal and all other known interferer signals are present.

76. (Previously Presented) The method of claim 73 wherein estimating the signature further comprises:

initializing a value for each signature to be estimated; and

iteratively repeating, until a computation to estimate a value for the signature does not alter the value by more than a predetermined amount, for each signature to be estimated:

computing an estimate value for a particular signature while holding the value of the other signatures at their values as initialized; and

using the estimate value as the value for the particular signature in successive computations.

77. (Previously Presented) The method of claim 56 wherein computing and modifying an antenna processing strategy comprises generating and modifying a set of weights to apply during processing for the remote user.

78. (Previously Presented) The method of claim 77 wherein the interferers comprise remote users, each having a corresponding weight for communicating with a wireless station, and wherein modifying the set of weights further comprises:

scaling the corresponding weights of each interferer by a selectable parameter;
and

adding the scaled weights to the set of weights of the remote user for which the antenna processing strategy is being computed.

79. (Previously Presented) The method of claim 78 wherein the parameter is selected to force the modified set of weights to be substantially orthogonal to the interferer signature.

80. (Currently Amended) An apparatus comprising:
a processor to compute an antenna processing strategy to define a transmitted signal or to process a received signal for a remote user, the computation based at least in part on received signal data; and

circuitry coupled with the processor, the circuitry to determine ~~the signatures~~ signature data of one or more interferers and to incorporate the signature data ~~interferer signatures~~ with the received signal data to modify the processing strategy to realize an improved null toward at least one interferer by reducing one or both of antenna transmit signal strength in, and sensitivity of the antenna to signals from, one or more interferers.

81. (Previously Presented) The apparatus of claim 80 wherein the circuitry to incorporate signature data relating to each interferer further comprises a combiner coupled with the processor to provide a combination of the received signal data and the signature data, the processor to compute a modified antenna processing strategy based, at least in part, on the combination.

82. (Previously Presented) The apparatus of claim 81 wherein to provide a combination of the received signal data and the signature data further comprises the circuitry to modify one or more characteristic features of the received signal data with an estimate of the one or more characteristic features in the signature data.

83. (Previously Presented) The apparatus of claim 82 wherein the estimate includes a selectable parameter.

84. (Previously Presented) The apparatus of claim 83 wherein the parameter selected is sufficiently large to cause a carrier to interference ratio (CIR) corresponding to the modified characteristic feature to be small.

85. (Previously Presented) The apparatus of claim 81 wherein the signature data comprises a known signature for the one or more interferers.

86. (Previously Presented) The apparatus of claim 83 wherein the parameter for a co-channel interferer is selected to cause a ratio on downlink of interferer transmit power to remote user transmit power to approximate a ratio of the modified feature estimate of interferer power to remote user power.

87. (Previously Presented) The apparatus of claim 83 wherein the one or more characteristic features of the received signal data comprises an estimate of the covariance of the received signal data.

88. (Previously Presented) The apparatus of claim 87 wherein the covariance estimate comprises a noise-plus-interference-plus-signal covariance estimate.

89. (Previously Presented) The apparatus of claim 87 wherein the covariance estimate comprises a noise-plus-interference covariance estimate.

90. (Previously Presented) The apparatus of claim 87 wherein to provide a combination of the received signal data and the signature data comprises the combiner to:

compute a covariance estimate of the received signal data;
compute a covariance estimate of the interferer signature data for each interferer;
and

sum the covariance estimate of the received signal data, and the covariance estimate of the interferer signature data scaled by a selectable parameter.

91. (Previously Presented) The apparatus of claim 87 wherein to provide a combination of the received signal data and the signature data comprises the circuitry to:

perform a matrix factorization of the received signal data;
perform a matrix factorization of the interferer signature data for each interferer;
scale the factors of the matrix factorization of the interferer signature data by a selectable parameter; and

combine the scaled factors and the factors of the matrix factorization of the received signal data.

92. (Previously Presented) The apparatus of claim 82 wherein to provide a combination of the received signal data and the signature data further comprises the combiner to combine the received signal data and supplementary signal data determined from each interferer signature, the supplementary data scaled by a selectable parameter.

93. (Previously Presented) The apparatus of claim 92 wherein the parameter selected is sufficiently large to cause a carrier to interference ratio (CIR) corresponding to the modified characteristic feature to be small.

94. (Previously Presented) The apparatus of claim 92 wherein the parameter for a co-channel interferer is selected to cause a ratio on downlink of interferer transmit power to remote user transmit power to approximate a ratio of the modified feature estimate of interferer power to remote user power.

95. (Previously Presented) The apparatus of claim 92 wherein the supplementary signal data includes random samples generated from the interferer signature data.

96. (Previously Presented) The apparatus of claim 92 wherein to provide a combination of the received signal data and the scaled supplementary signal data comprises the combiner to:

perform a matrix factorization of the received data and the signature data; and
combine the resulting factors.

97. (Previously Presented) The apparatus of claim 81 wherein to incorporate interferer signature data further comprises:

a signature estimator circuit coupled with the circuitry to estimate the signature of one or more of the interferers; and

the processor to modify the antenna processing strategy by incorporating the estimate as the interferer signature data.

98. (Previously Presented) The apparatus of claim 97 wherein to estimate the signature comprises the estimator to determine a high likelihood estimate of an interferer signature, the determination based on the assumption that no remote user signal and no other interferer signals are present.

99. (Previously Presented) The apparatus of claim 97 wherein to estimate the signature comprises the estimator to determine a high likelihood estimate of an interferer signature, the determination based on the assumption that the remote user signal and all other known interferer signals are present.

100. (Previously Presented) The apparatus of claim 97 wherein to estimate the signature further comprises the estimator to:

initialize a value for each signature to be estimated; and

iteratively repeat, until a computation to estimate a value for the signature does not alter the value by more than a predetermined amount, for each signature to be estimated:

compute an estimate value for a particular signature while holding the value of the other signatures at their values as initialized; and

use the estimate value as the value for the particular signature in successive computations.

101. (Previously Presented) The apparatus of claim 81 wherein to compute an antenna processing strategy comprises the processor to generate a set of weights to apply during processing for the remote user, and wherein to modify the processing strategy comprises the circuitry to adjust the set of weights.

102. (Previously Presented) The apparatus of claim 101 wherein the interferers comprise remote users, each having a corresponding weight for communicating with a wireless station, and wherein to adjust the set of weights further comprises the circuitry to:

scale the corresponding weights of each interferer by a selectable parameter; and
add the scaled weights to the set of weights of the remote user for which the antenna processing strategy is to be computed.

103. (Previously Presented) The apparatus of claim 102 wherein the parameter is selected to force the modified set of weights to be substantially orthogonal to the interferer signature.

104. (Currently Amended) An article comprising a machine-accessible medium to provide content to cause one or more electronic systems to:

compute an antenna processing strategy to define a transmitted signal or to process a received signal for a remote user, based at least in part on received signal data;
determine ~~one or more signatures~~ signature data of one or more interferers; and
modify the antenna processing strategy to realize an improved null toward at least one interferer by incorporating the determined ~~one or more signatures~~ signature data of the one or more interferers with the received signal data to reduce one or both of antenna transmit signal strength in, and sensitivity of the antenna to signals from, one or more interferers.

105. (Previously Presented) The article of claim 104 wherein incorporating signature data relating to each of one or more interferers comprises the one or more electronic systems to:

combine the received signal data and the signature data; and
compute a modified processing strategy based, at least in part, on the combination.

106. (Previously Presented) The article of claim 105 wherein to combine the received signal data and the signature data further comprises the one or more electronic systems to:

perform a matrix factorization of the received data and supplementary signal data determined for each interferer signature; and

combine the resulting factors of the received data, with the resulting factors of the supplementary signal data scaled by a selectable parameter.

107. (Previously Presented) The article of claim 105 wherein to combine the received signal data and the signature data further comprises the one or more electronic systems to modify one or more characteristic features of the received signal data with an estimate of the one or more characteristic features in the signature data.

108. (Previously Presented) The article of claim 107 wherein the estimate includes a selectable parameter.

109. (Previously Presented) The article of claim 108 wherein to combine the received signal data and the signature data comprises the one or more electronic systems to:

compute a covariance estimate of the received signal data;
compute a covariance estimate of the interferer signature data for each interferer;
and
sum the covariance estimate of the received signal data, and the covariance estimate of the interferer signature data scaled by a selectable parameter.

110. (Previously Presented) The article of claim 108 wherein to combine the received signal data and the signature data comprises the one or more electronic systems to:

perform a matrix factorization of the received signal data;
perform a matrix factorization of the interferer signature data for each interferer;
scale the factors of the matrix factorization of the interferer signature data by a selectable parameter; and
combine the scaled factors and the factors of the matrix factorization of the received signal data.

111. (Previously Presented) The article of claim 104 wherein to modify the antenna processing strategy by incorporating signature data further comprises the one or more electronic systems to:

estimate the signature of one or more of the interferers; and
modify the antenna processing strategy by incorporating the estimate as the interferer signature data.

112. (Previously Presented) The article of claim 111 wherein to estimate the signature further comprises the one or more electronic systems to:

initialize a value for each signature to be estimated; and
iteratively repeat, until a computation to estimate a value for the signature does not alter the value by more than a predetermined amount, for each signature to be estimated:

compute an estimate value for a particular signature while holding the value of the other signatures at their values as initialized; and

use the estimate value as the initial value for the particular signature in successive computations.

113. (Previously Presented) The article of claim 104 wherein to compute and to modify an antenna processing strategy comprises the one or more electronic systems to generate and to adjust a set of weights to apply during processing for the remote user.

114. (Previously Presented) The article of claim 113 wherein the interferers comprise remote users, each having a corresponding weight for communicating with a wireless station, and wherein to adjust the set of weights further comprises the one or more electronic systems to:

scale the corresponding weights of each interferer by a selectable parameter; and
add the scaled weights to the set of weights of the remote user for which the antenna processing strategy is to be computed.